The French Energy & Climate Strategy and the Future Role of Nuclear Electricity

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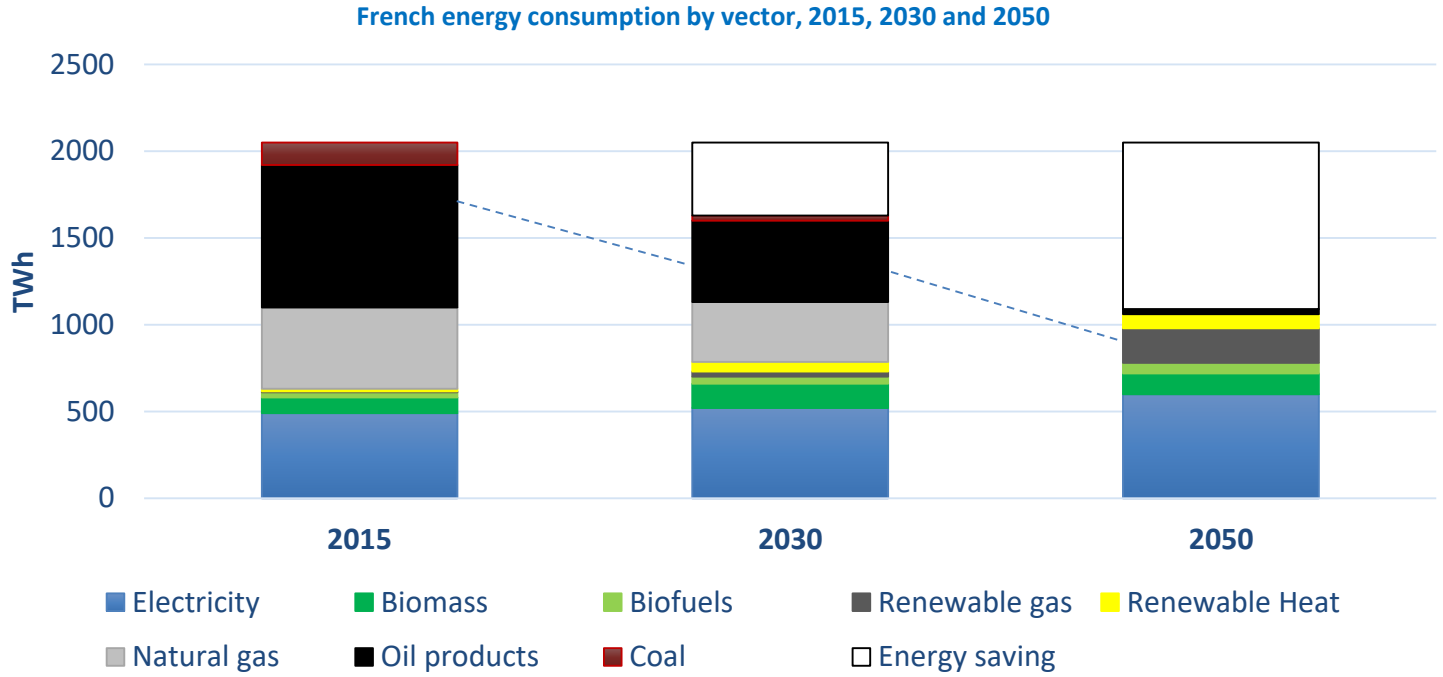
Bruegel, 15/05/19

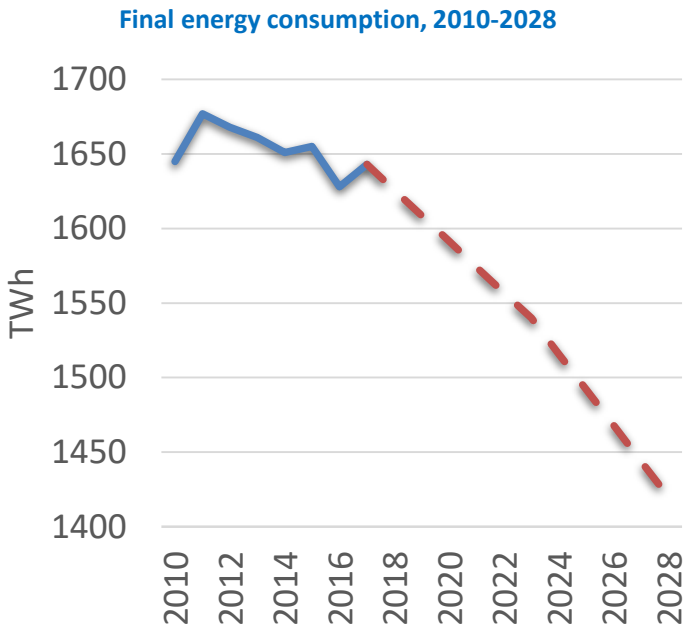
Targeting net zero emissions by 2050



Source: Draft SNBC

- Carbon neutrality implies a very sharp drop in energy consumption following strengthened EE efforts and a supply mainly composed carbon-free electricity, bioenergies and renewable heat

Policy actions to reduce final energy consumption in all sectors (by 2028)



Source: Draft PPE

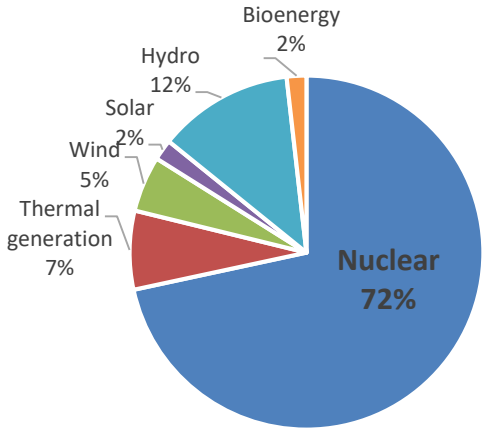
MAIN POLICY MEASURES

- Carbon pricing (€86/t in 2022)
- 2.5 million homes renovated by 2023
- Public support for high-performing heating systems
- White certificate scheme beyond 2021
- EU emission standards in the automotive sector + support to car-sharing

- Final energy consumption to decrease by 7% in 2023 and by 14% in 2028 compared to 2012 levels

Nuclear, the backbone of the French electricity system

French electricity production by source, 2018



Source: RTE, bilan 2018

- 63.1 GW installed nuclear capacity
- 393.2 TWh of nuclear electricity produced in 2018
- ≥90% decarbonized electricity mix
- Retail electricity prices about 15% lower than EU average for households (€0.1754/ KWh)

Location of the 58 operational nuclear reactors

Source: EDF, 2019

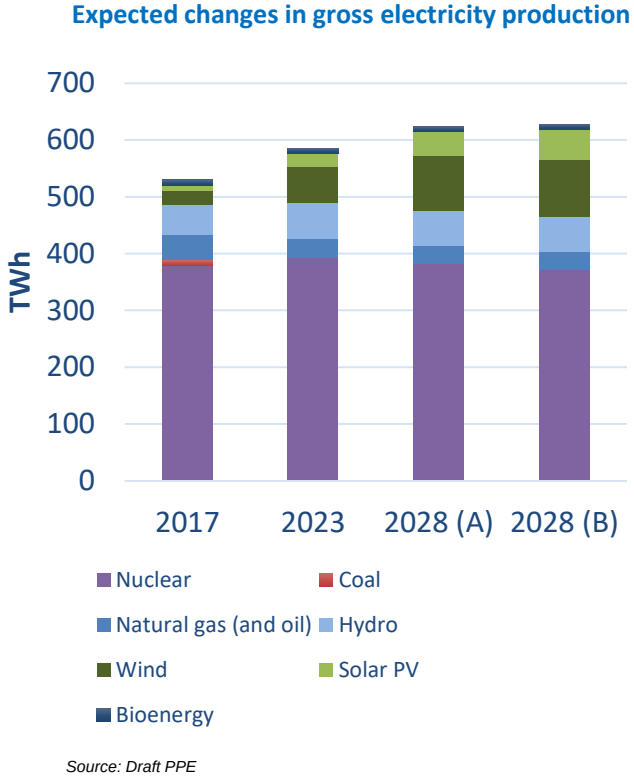
Capacity	Number of reactors
1450 MW	4
1300 MW	20
900 MW	34
1650 MW (under construction)	1 (mid-2020)

Towards a more diversified electricity mix

- 50% nuclear target shifted to 2035 ➔climate protection comes before the diversification goal

CAPACITY CLOSURES

- Fessenheim (2 reactors) to be closed by Spring 2020
- All four coal stations (35% of CO_2 emissions from the power sector) to be closed by 2022, unless adequacy issues
- 2 nuclear reactors to be closed in 2027-2028
- *Possibly 2 additional reactors to be closed in 2025-2026 (decision in 2023)* ***IF*** *the regional context is favorable*
- 50% nuclear by 2035 ➔ closing 14 reactors in total

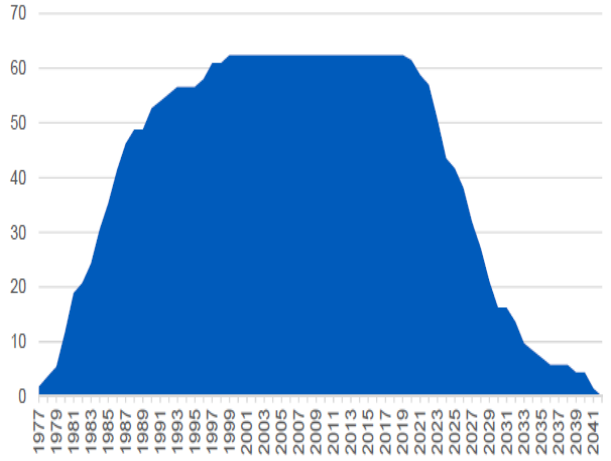


Source: Draft PPE

Extending the technical life-time of reactors, while planning a gradual decommissioning

- On average, French reactors are 31 years old
- 75% of all French reactors will reach the 40 years threshold by 2030
- **« GRAND CARENAGE » :** Investment programme to modernize existing reactors and ensure a safe and high-performing operation beyond 40 years, with the approval of the Nuclear Safety Agency
  - €4bn/yr over 2014-2025
  - 4th ten-year inspection to start with the 900MW reactors, in 2019 for Tricastin

French nuclear capacity (GW) assuming a 40 year technical lifetime



Source: EDF

- Assuming a max. 60 yr technical life-time, 50GW of nuclear capacity will have to be put offline by 2050 ➔ **a gradual phase out is necessary to avoid a cliff-edge effect**

Building new reactors : a topic for the next Presidential campaign

- Beyond 2030-2035, new decarbonized electricity production means will have to be built:
  - Renewables + storage and other decabonized flexibility sources ?
  - Renewables + new nuclear ?
- Keeping the nuclear option « open », what implications?
  - Maintaining the industrial capacity after EPR I
  - Long delivery time: close to 10 years needed between the decision and the commissioning of the first pair of reactors, then 1 reactor could be commissioned every 1-2 years (*EDF*)
- By mid-2021, the government will gather « all elements needed » to take an informed decision on the need to build new nuclear reactors

Key factors weighing in future decision

- Commissioning of Flamanville EPR by mid-2020 / implementation of Hinkley Point C project
- Ability of the French nuclear industry to define a competitive « EPR2 » offer & to define a robust waste management strategy
- Industrial sovereignty dimension:
  - Nuclear: French industry spanning the full range of nuclear activities, 220 000 jobs, mostly highly-qualified
  - Nuclear exports / Sino-Russian duopoly / non-proliferation strategy
- Regional / EU dimension:
  - Influence of neighbouring countries' experience, including the success of Germany's Energiewende and coal phase out plan
  - Approval by the EU Commission will be necessary for a new remuneration / risk-sharing scheme
  - EU debate over carbon neutrality by 2050

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